

**P. G. DIPLOMA IN ANALYTICAL
CHEMISTRY (PGDAC)**

Term-End Examination

December, 2024

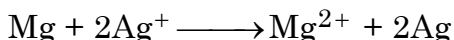
**MCH-004 : ELECTROANALYTICAL AND
OTHER METHODS**

Time : 3 Hours

Maximum Marks : 75

Note : Attempt any *five* questions. All questions carry equal marks.

1. (a) Define any *two* of the following terms : 5
- (i) $E_{1/2}$
 - (ii) Diffusion current
 - (iii) Polarographic maxima
 - (iv) Limiting current
 - (v) Residual current
- (b) Calculate the EMF of the cell in which the following reaction occurs : 5



Given :

$$[\text{Mg}^{2+}] = 0.10 \text{ M}; [\text{Ag}^+] = 1.0 \times 10^{-4} \text{ M}$$

$$E^\circ_{\text{Mg}^{2+}/\text{Mg}} = -2.363 \text{ V}$$

$$E^\circ_{\text{Ag}^+/\text{Ag}} = +0.799 \text{ V}$$

- (c) What are ion selective electrodes ? Explain their working by citing an example. Comment on the application of these types of electrodes. 5
2. (a) The resistance of a conductivity cell containing 0.01 mol dm^{-3} KCl is 150Ω . The same conductivity cell containing 0.01 mol dm^{-3} HCl gives the resistance of 51.4Ω . The conductivity of KCl solution is $1.4 \times 10^{-3} \Omega^{-1} \text{ cm}^{-1}$. Calculate the following values : 5
- (i) Cell constant
- (ii) Conductivity of the HCl solution
- (b) What are the amperometric titrations ? Draw common types of curves obtained in such titrations. 5
- (c) Write Ilkovic equation. How is it used for determination of trace metal ions ? 5

3. (a) What is meant by Hydrodynamic Voltammetry ? How is the flow of solution carried out in hydrodynamic voltammetry ? 5
- (b) Briefly explain the principle of Cyclic Voltammetry and discuss its applications. 5
- (c) What are capillary characteristics ? How do these affect diffusion current in polarography ? 5
4. (a) Explain the radio-tracer techniques with the help of suitable examples. 5
- (b) A radioactive substance was counted repeatedly and counts obtained were 15897, 15689, 15753, 15815, 15795, 15627, 15532. Calculate the mean deviation and standard deviation. 5
- (c) 53.8 mg steel sample was analyzed for its manganese content by neutron activation analysis following comparator method. 68.5 mg standard steel sample containing 0.96% Mn was irradiated along with sample in

the Cf^{252} source and counted under the same experimental conditions. Activity of the sample and the standard counted for 5 min. were 16597 and 21983 counts respectively. Calculate the % amount of Mn in the steel sample. 5

5. (a) What is the effect of complexing agent on the reduction of ion in polarography ? Explain. 5
- (b) Describe the procedure for determination of Zn with EDTA with the help of Amperometry. 5
- (c) What is liquid junction potential ? How can it be minimized ? 5
6. (a) List the common source of error in TGA. 5
- (b) A thermogram of magnesium compound shows a loss of 91.0 mg from a total of 175.0 mg used analyte. Identify the compound as MgO or MgCO_3 or MgC_2O_4 . (Mr. for $\text{MgCO}_3 = 84.3$, $\text{MgC}_2\text{O}_4 = 112.3$). 5
- (c) Differentiate between DTA and DSC. 5

7. (a) What are the various neutron sources available for neutron activation analysis ? Draw a neutron energy spectrum in a nuclear reactor. 5
- (b) Describe all the sources of background activity. Explain how background activity can be minimized. 5
- (c) Explain thermometric titrations. In what respects are these different from ordinary acid-base titrations ? 5
8. (a) Describe constant potential electrolysis. Give its applications. 5
- (b) What is Ohmic potential ? How is it related to cell potential and applied potential ? 5
- (c) What are conductometric titrations ? Explain the curves obtained in the titration of : 5
- (i) a strong acid and strong base.
- (ii) a strong acid and weak base.

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